



Original Research Article

Comparative analysis of the effect of two behaviour modification techniques on children of 4-7 years as chosen by parents and pedodontists

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ABSTRACT

Introduction : Pediatric dentistry involves not only a high level of technical expertise, but also a positive psychological environment for every child to improve the overall dental experience for the young ones.

Aim & Objective: The aim of this study was to compare the effectiveness of two psychological behaviour modification techniques (BMT) in managing the behaviour and dental anxiety levels in a child.

Materials and Methods: A total of 200 children of 4-7 years of age who were to undergo pulpectomy was randomly divided into 2 groups to be managed by two BMTs selected by a poll among Pedodontists which was Parental presence and through a survey done among parents of the children included in the study which was Positive Reinforcement. Frankl's Behaviour rating and child anxiety levels were evaluated.

Results: Both the techniques were found to be similar in effectiveness in handling anxious children though Parental presence lowered anxiety among children much more than Positive Reinforcement especially on first visits.

Conclusion: Both the modification techniques if used together, can increase the effectiveness in handling pediatric patients in a dental operatory.

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1. Introduction

Psychological behaviour management of a child in a dental clinic includes methods to obtain a child's approval to get him treated on a dental chair.¹ It encompasses patient and parent education, listening and proper communication with empathy.² Pediatric dentistry is a unique field of dentistry which involves not only high level of technical expertise necessary to meet the needs of young patients,³ but also requires creating a positive psychological environment and communicative management of every child in order to improve the overall dental experience for the young ones.⁴ But the basic philosophy of pediatric dentistry always gets

back to the first definition of behavior management given by Mc Elroy in 1895 even if the operative treatment is a success, the appointment is a failure if the child leaves the dental clinic in tears.⁵ Psychological behavior management was defined by Wright in 1975 as the way the dental team would efficiently perform treatment on a child patient and instil a positive attitude in the child towards dental treatment at the same time.²

It was observed in a study conducted in private Pedodontics practice, that the proportion of children with negative behavior during dental treatment was 21% the proportion children with fear of dental treatment was 20%. Children with dental fear had greater tendencies of presenting negative behavior and vice versa. Thus, if pediatric dentists screened for dental fear in children, it

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may allow them to prepare children more adequately for positive treatment experiences.⁶ Knowing the age of a child patient can help the dentist assess the behavioral maturity of the child, but the dentist must also assess the other factors like his or her physical development, socializing skill, intellectual and speech development.⁷ Behaviour guidance is a comprehensive and on-going process employed to initiate and support the child-dentist association. It aims to establish better communication to build a trusting relationship between dentist and child, alleviate fear of dental treatment and anxiety of the child, deliver quality dental service and to instill an overall positive dental attitude towards oral health care.⁸

This study was conducted to evaluate the effectiveness of the most preferred nonpharmacological behaviour modification technique (BMT) by the Pediatric dentists and the parents to be applied on the children during the procedure and to assess the child anxiety levels during the process. The null hypothesis tested was that there is no significant difference in the effectiveness of the two techniques.

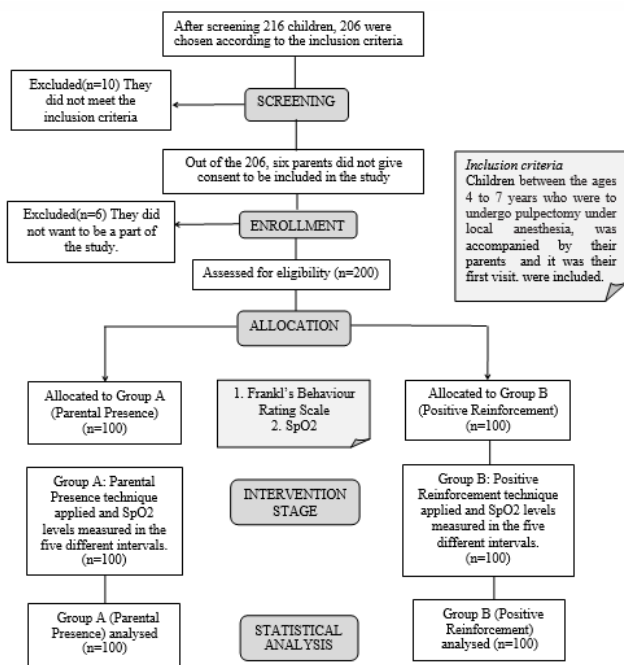


Figure 1: Consort flowchart of children's participation in the study.

2. Materials and Methods

This study was conducted in the Department of Pedodontics and Preventive Dentistry, Kalinga Institute of Dental Sciences for a period of one year after obtaining approval from the Institutional Review Board and Ethics Committee (IEC No.: KIMS/KIIT/IEC/194/2018) and written informed consent from the parents of the children.

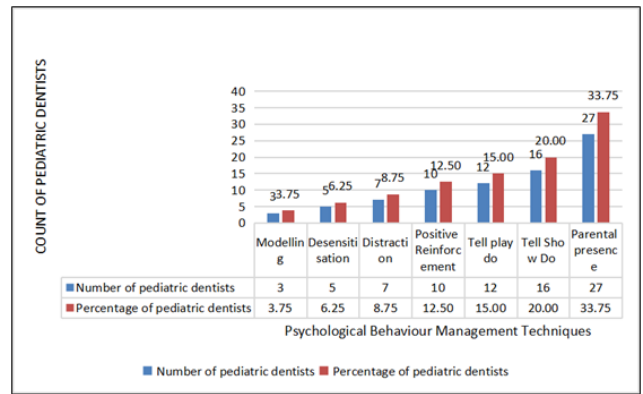


Figure 2: The poll results of the most preferred technique by the pediatric dentists and post graduate trainees hailing from Odisha, West Bengal and New Delhi

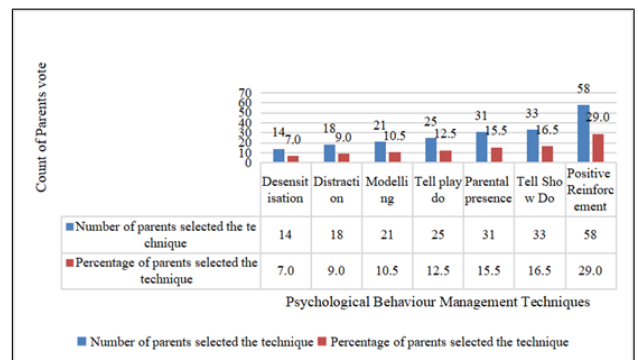


Figure 3: The survey results of the most preferred psychological behaviour management technique selected by the parents to be applied on their child

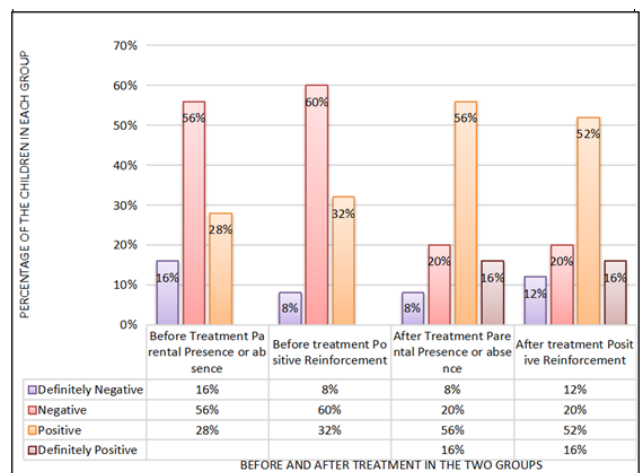


Figure 4: Percentage of children's behaviour before treatment and after treatment in the two groups

Table 1: Behaviour ratings before treatment

Frankl's Rating	Group A: Parental Presence	Group B: Positive Reinforcement	Total
Definitely Negative	16 16.0%	8 8.0%	24 12.0%
Negative	56 56.0%	60 60.0%	116 58.0%
Positive	28 28.0%	32 32.0%	60 30.0%
Total	100 100.0%	100 100.0%	200 100.0%

N Count; P percentage;
a Frequency distribution of the behaviour rating before treatment

Table 2: Behaviour ratings after treatment

Frankl's Rating	Group A: Parental presence	Group B: Positive Reinforcement	Total
Negative	8 8.0%	12 12.0%	20 10.0%
Definitely Negative	20 20.0%	20 20.0%	40 20.0%
Positive	56 56.0%	52 52.0%	108 54.0%
Definitely Positive	16 16.0%	16 16.0%	32 16.0%
Total	100 100.0%	100 100.0%	200 100.0%

N Count; P percentage;
a Frequency distribution of the behaviour ratings after treatment

Table 3: Levene's test for equality of variances

F	p value	t	df	Sig. (2-tailed)
Before Treatment	.003	.954	-.671	48
After Treatment	.382	.539	-.671	47.443
			.331	48
			.331	47.641

df Degrees of freedom; t t-Test value; Sig. (2-tailed) Significance; F Ratio of two variances;
a Comparison of both the groups A and B

Table 4: Pearson's chi-squared test

	Value	Std. Deviation	Std. Error of Mean	Exact Sig. (1-sided)	df	Sig.(2-tailed) p value
Parental Presence Before And After	131.837	.690	.067		6	.000
Positive Reinforcement Before And After	107.308	.872	.116	-2.753	6	.000

df Degrees of freedom; Sig. (2-tailed) Significance; Std Standard;
a The statistical analysis shows significant p value when analyzing both the groups before and after the treatment

Table 5: Paired samples statistics of pulse rate

	Mean	Standard Deviation	Standard Error Mean
Pair 1 parental presence	97.80	5	6.943
positive reinforcement	103.00	5	5.000

: Count; a Paired sample test of the mean pulse rate readings of the various stages

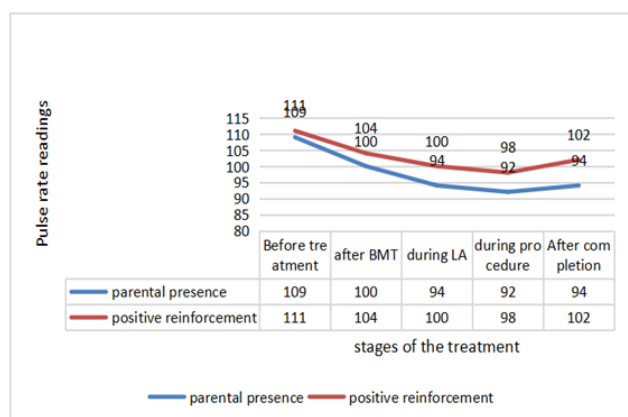
Table 6: Paired samples correlations of the pulse rate

Pair 1	Parental presence & positive reinforcement	5	Correlation	Sig.
N:Count;			.979	.004
aPaired sample	Correlations of the mean pulse rate readings of the various stages			

Table 7: Paired samples test

		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference		t	df	Sig. (2-tailed)
					Lower	Upper			
Pair 1	Parental presence - positive reinforcement	-5.200	2.280	1.020	-8.031	-2.369	-5.099	4	.007

N count; Sig significance; df Degrees of freedom; t t-Test value; Sig. (2-tailed) Significance; Std Standard; aPaired sample test of the mean pulse oxymetric readings of the various stages

**Figure 5:** Graph showing the mean pulse oxymetric readings of the children in the two groups during the five intervals of the procedure

2.1. Study Design

This interventional, randomized clinical trial study with parallel groups designed following the CONSORT guidelines. The sample size was calculated considering the children who could be managed with the non-pharmacological BMT as the primary outcome. Also, it was calculated considering the normal variate (at 5% type I error ($P < 0.05$; $\alpha = 0.05$)) is 1.96. According to previously published studies children who could be managed using nonpharmacological BMT may not be more than 85%,⁹ makes sample size around 196 children. If we consider a possible loss of 10% thus, the sample size calculated was 216 children ($n=108$ for each group).⁹

2.2. Recruitment, randomization, and allocation

A flow diagram depicting the screening, allotment, and allocation of the children through the randomized clinical

trial is presented in Figure 1 (CONSORT flowchart of children's participation in the study). The study included 200 children, aged 4 to 7 years, with equal distribution in both genders from the Out-patient department of Department of Pedodontics and Preventive Dentistry of Kalinga Institute of Dental Sciences, KIIT University, Bhubaneswar, Odisha. Simple random sampling technique (drawing from the hat method) was used to distribute 200 screened children into two groups of 100 each.

2.3. Eligibility criteria

2.3.1. Inclusion criteria

1. Children for whom it was their first visit to the dentist
2. Children who were accompanied by their parents
3. Children between the ages 4 to 7 years of age
4. Children who were to undergo pulpectomy under local anesthesia

2.3.2. Exclusion Criteria

1. Children whose parents did not accompany them.
2. Children who have had previously been to a dentist.
3. Special children with mental / cognitive problems.
4. Teeth extensively damaged by caries
5. Teeth which is carious with pre-shedding mobility.
6. Conditions which were compromising medically and developmentally or both.

2.4. Study groups

A poll was conducted to assess the most preferred psychological BMT among the pediatric dentists and post graduate trainees. The techniques included in the poll were Tell show do, Tell play do, Modeling, Distraction, Parental presence, Positive Reinforcement, Desensitisation. The most preferred technique was applied on the children of group A. A survey was done to assess the most preferred

technique of the parents of the 200 children among the same seven psychological BMTs. The most preferred technique was applied on the children of group B. Both groups underwent pulp therapy treatment under local anaesthesia and their oxygen saturation was noted using pulse oximeter.

2.5. Data collection

80 pediatric dentists and postgraduates trainees who agreed to be a part of the survey were included hailing from the states of Odisha and West Bengal and the union territory of New Delhi. In Group A, children were managed by non-universal Parental presence technique as preferred by most pediatric dentists and postgraduates trainees. The parents of all the 200 children were asked to watch a video clip showing the different psychological BMT that were previously included in the poll for the pediatric dentists and post graduate trainees. They were asked to select the best psychological BMT according to them to manage their children. The parents' preferred technique was Positive Reinforcement technique which was applied to manage the children in Group B.

2.5.1. Children's dental anxiety

All fear measurements were performed by a single examiner to avoid the need for any calibrations. The level of dental anxiety of each patient was measured using a finger pulse oximeter (model number: P2000; ShenZhen YuanKe ShunHe Electronic Technology Pvt. Ltd.) at five stages of the procedure, which were:

1. (a) Stage 1: Before the start of the treatment procedure (in waiting/ reception area)
- (b) Stage 2: Pre-operatively, after applying the behavior management technique
- (c) Stage 3: During administration of local anesthesia
- (d) Stage 4: During treatment while injecting local anesthesia and using arotor)
- (e) Stage 5: After completion of the treatment.

The readings from the pulse oximeter were recorded at each of the five intervals for every child in both the groups. All the readings were recorded by a single clinician to avoid bias.

2.5.2. Children's behavior levels

Every child's behaviour was evaluated based on Frankl Behavior Rating scale (Frankl et al.,1962) before and after the procedure.¹⁰ This scale consists of four behavioral categories: (1) definitely positive, (2) positive, (3) negative, and (4) definitely negative. During treatment, another clinician rated the children's behavior.

2.6. Treatment procedure

All dental procedures were performed in the same operator. The operator, a pediatric dentist, carried out all dental treatment procedures. A clinician was asked to rate the children on their behaviour before and after pulpectomy procedure were performed.⁵

2.7. Statistical analysis

All the responses that were coded to maintain confidentiality of the study participants. Data analysis was done using SPSS software, version 22.0 (SPSS Inc., IBM Corporation, NY, USA).¹¹ Descriptive analysis was performed to assess how comparable the groups were at the beginning of the study. Levene's test was used to establish the homogeneity of variances of the two groups. The differences between the effectiveness of the two techniques used in the groups were assessed using Pearson's Chi-squared test (level of statistical significance considered was 0.05) and the oxygen saturation levels were analysed using the sample t test which is used for numerical data.

3. Results

According to the poll, the most preferred technique by the pediatric dentists and post graduate trainees hailing from the states of Odisha and West Bengal and the union territory of New Delhi was Parental presence (Figure 2). The most preferred psychological behaviour management technique selected by the parents as per the survey was Positive Reinforcement (Figure 3). Behavior of the children were rated before the treatment and after the treatment using Frankel's Behavior Rating Scale.

It was observed that in group A, before treatment 16% children were definitely negative and 56% were negative in behaviour while only 28% of the children were positively behaved. On the other hand, in group B, before treatment 8% children were definitely negative and 60% were negative in behaviour while only 32% of the children were positively behaved. (Table 1) After application of the behaviour management techniques, post treatment it was observed that in group A, 8% children were still definitely negative and 20% were negative in behaviour while 56% of the children were positively behaved and 16% were positive. On the other hand, in group B, after treatment 12% children were still definitely negative and 20% were negative in behaviour while 52% of the children were positively behaved and 16% were definitely positive. (Table 2).

Thus it can be concluded from the above two table that in group A, 28% children with positive behaviour before treatment have turned to 72% (56% positive and 16% definitely positive) after treatment with the application of non-universal behaviour modification technique - Parental presence; and in group B, 32% children with positive behaviour before treatment have turned to 68% (52%

positive and 16% definitely positive) after treatment with the application of behaviour modification technique - Positive reinforcement.

Conversely it can be concluded that behavior of the children before treatment, 72% of the children showing 'negative' and 'definitely negative' behavior in group A were reduced to 28% negative and 'definitely negative' after treatment with the application of non-universal behaviour modification technique - Parental presence. About 68% of children showing negative and definitely negative behavior in group B before treatment were reduced to 32% negative and definitely negative behavior after treatment with the application of behaviour modification technique - Positive reinforcement. (Figure 4) Levene's Test for Equality of Variances was done and the p value of the both the groups after treatment are non-significant (p value = 0.382 for after treatment) as both the techniques are similar in effectiveness in handling negatively behaved children in the dental operator. Thus the null hypothesis is proved. (Table ??) The p-value for both the groups when before treatment and after treatment scores are compared are found to be significant (p value = 0.000 for group A, p value = 0.011 for group B) as Pearson's Chi-squared test. The two techniques applied: Positive reinforcement and Parental presence technique are thus both found to be effective in modifying negative behaviour in a pediatric patient to a positive one. Both groups showed significant difference in the behavior between the before treatment and the after-treatment groups. The results obtained showed that the effectiveness of the two techniques is found to be similar thus proving the null hypothesis (Table 4).

The mean of the readings from the pulse oximeter which were recorded at each of the five intervals for every child in both the groups showed that the anxiety level before start of the treatment was higher than after behaviour management technique were applied followed by a slight dip during the local anesthesia application followed by the procedure but the anxiety was low after completion of the procedure (Figure 5). The two groups showed significant difference in anxiety levels during the various intervals of the procedure. It was observed that parental presence during a child's first dental visit lowers the anxiety in the child. The rise in the pulse rate was observed due to anxiety or panic. Paired sample showed significant difference in the level of pulse rates in the two groups with group A exhibiting lower anxiety levels compared to group B. (Tables 5, 6 and 7) Thus even if both the techniques are equally effective in managing negatively behaved children in the dental operator but Parental presence alleviate child's anxiety considerably while undergoing procedures during their first dental visit.

4. Discussion

It has been observed that in very young children, teeth get affected by early childhood caries and it has a huge disease burden so pulpectomy procedure is needed as an intervention in most cases to restore functionality.^{12,13} Thus, pulpectomy procedure under local anesthesia was chosen as the intervention of the study which requires complete behaviour shaping of the young child. According to Jean Piaget, children aged 4-7 years in the pre-operational phase. The development in speech, attention span, and abilities to concentrate are formed in this phase which is a sign of their preparedness for social communication. Hence, this age group is correct for checking BMT¹⁴ and the beneficial effects of these in children. In this present study, the children aged between 4–7 were chosen, as separation anxiety is commonplace in very young children, i.e. below 4 years of age and is a normal stage of development and it fades as child grows older.¹⁵ The first dental experience is pivotal in shaping a child's perception towards dentistry and dental treatment.¹⁶ Cooperation of the child during dental procedures is important to deliver effective and quality treatment outcomes.¹⁷ It is an essential and healthy adaptation made by a child in order to develop cognitively and emotionally.¹⁷ Another reason is that children below 4 years of age are not psychologically developed enough to comprehend full verbal communication hence, it is essential for them to be treated in the parent's presence.¹⁸ Psychological and cognitive development occurs during the age of 4–7 years and after the age of 7 years, as there is a development of autonomy and trust, thus the parental presence or absence does not have much effect on the child's psyche.¹⁹ Although dental phobia can adversely impacts a person's quality of life making it imperative to recognize and alleviate these fears to make way for improved oral and overall well-being of the individual. Considering above stated factors, the age group of 4–7 years was found to be more appropriate for the current study.²⁰

Previously, dentists believed that if parents were excluded from dental operator, it would make it possible to avoid their interference in the dentist's rapport with the child.²¹ Parental presence technique in dental clinic is advocated nowadays in order to gain emotional support and avoid the trauma of separation from parents.²² The parent-in technique in dental operator is underused, or misused²³ as compared to the more common positive reinforcement technique used in group B. The effective use of the parent-in technique along with minor modifications to it if required, can make it easier to manage young children apprehensive to dental treatments.¹⁰

Previously done research conducted by Frankl in 1962, Pffefferle in 1982 explained that with only mildly fearful or anxious children, passive parental presence does not adversely affect the child's behaviour.²⁴ In pre-school children passive parental presence has a positive effect.

However, if a parent is directly communicating with their child during treatment, it can make the communication of the dentist with the child difficult.¹⁰

The other technique used in the study is positive reinforcement technique which is based on the clinician's reinforcement to encourage any positive behaviour shown by the patient to cooperate during the procedure with compassionate phrases (using an encouraging voice modulation), such as "thank you for keeping your mouth wide open and helping me to treat you", or physical manifestation, such as a smile. Skinner defined Operant conditioning as behavior which is controlled by its consequences which was previously termed as "instrumental learning" and would commonly be called habit. A well-trained operant is literally a habit.²⁵ When a behaviour that follows a stimulus is reinforced, it is strengthened, and is more likely to recur and vice versa. Behaviour can be reinforced positively or negatively.²⁶ If a child dental patient receives something of value, tangible or otherwise because of a particular behaviour, then that behaviour has been positively reinforced. When a certain unwanted behaviour like screaming and crying is immediately followed by the removal of an unpleasant stimulus that is dental treatment in this case, it is potentially negatively reinforced. Contrarily, if the child obliges to their dentist's request for cooperative behaviour followed by the dentist rewarding the behaviour with a smile, a warm look, a "thank you for keeping your mouth open wide and helping me", or a gift like a sticker or pencil it would count as a technique of contingency management or operant conditioning as per Skinner, 1938. The other part is 'punishment', when the impact on a child that the behaviour is more likely to recur in the future, in similar circumstances. A negative reinforcement situation would be when a highly anxious child runs from the dental operatory and is allowed by his parent to simply go home without any treatment being done; the result of this kind of behaviour is immediate elimination of the unpleasant stimulus which is anxiety due to dentistry, and thus the behaviour of running away from dentists or dental treatment is likely to have been strengthened. Positive reinforcement for a fearful child is a moment of escape from the anxiety-inducing circumstances related to dental treatment. When cooperative behaviour is sustained throughout the entire dental appointment, the patient might also receive a tangible reward for the positive behaviour, e.g. sticker badge, toy, etc. as an appreciation.²⁷ When parents were asked the reason behind their choice, they found this technique like the ones they use at home to make the child study or perform better at school. They said that though they did not quite know that it was a technique or has a name, but it is a very effective method, and the child is generally encouraged at home environment using Positive Reinforcement technique.

Frankl's behavior rating scale (FBRS), developed in 1962, has been used in this study, as it is one of the most prolifically used and reliable behavior evaluation four-point scales used in pediatric clinical practice as well as dental research. It classifies child behavior based on the attitude of the child into four groups with two degrees of positive behavior and two degrees of negative behavior groups starting from definitely negative to definitely positive during dental treatment, though this classification does not have specific checklists for observation.^{11,28}

Finger pulse oximeter is a reliable device for measuring oxygen saturation in dental settings which enables detection of hypoxia in tissues, also helps to monitor and control the effect of the treatment decisions. Another use of pulse oximetry in pediatric dentistry is measuring their pulse rate during dental appointments as it assesses the levels of patients' dental anxiety objectively. The rise in the pulse rate is indicated by high levels of stress and anxiety during the dental visit.^{29,30} Pulse rate measurement is a non-invasive and objective technique for the assessing the physiological alterations caused due to the subjective nature of anxiety.^{31,32} There are numerous study findings which suggested finger pulse oximeter as the most acceptable method to measure a patient's heart rate as that can also be used as a parameter to evaluate patient's anxiety levels.^{14,33}

This study was designed to compare the efficiency of the Parental presence and Positive Reinforcement techniques in managing the behaviour of the children and in reducing child anxiety during dental treatment. The results of this study showed that the Parental presence technique is more effective than the Positive reinforcement technique though not statistically significant on child anxiety levels as well as increased positive, cooperative behavior during dental treatment among 4–7 year old children. Thus, both the non-pharmacological behaviour management techniques were equally effective in managing a negatively behaved child without any significant differences between the two techniques chosen either by the parents or the Pedodontists, while a significant difference was found in the behavior of the children before the application of the non-pharmacological behaviour management technique and after applying the said technique clearly demonstrating the effectiveness of both the techniques applied. The mean pulse rates of the children in the two groups shows that the anxiety levels are significantly different for the two groups which has an impact on the behaviour of the children in the two groups.

4.1. Limitations

These results are concluded based on the outpatient department of a single institute, but they may be indicative of dental practice and therefore may be helpful for anticipating how child patients will behave in a dental operatory. Additionally, since the same clinician was both

the deliverer of service and conducted the behavior rating and measured the pulse rate, confirmation bias may have been introduced.

5. Conclusion

This study brings forth that nonpharmacological behaviour management techniques can be successfully used to regulate most of the children in a pediatric clinic set-up. The two techniques applied: Positive reinforcement and Parental presence are both found to be effective for handling children in a pediatric dental set up. Though both the techniques are similar in effectiveness, the non-universal Parental presence technique was found to be a more effective behaviour modification tool in the present study. If both the modification techniques are used together, it can be more effective in handling pediatric patients in a dental operatory.

6. Source of Funding

Information that explains whether and by whom the research was supported)

7. Conflicts of Interest

Competing interests (include appropriate disclosures): There are no conflicts of interest.

8. Ethics Approval

(Include appropriate approvals or waivers): institutional review board ethical clearance.

9. Authors' Contributions

1. Data collection and manuscript preparation,
2. Manuscript preparation.

We confirm that the manuscript has been read and approved by all named authors and that there are no other people who satisfied the criteria for authorship but are not listed. We further confirm that the order of authors listed in the manuscript has been approved by all of us.

10. Source of Funding

None.

11. Conflict of Interest


None.


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